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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/716,729	11/19/2003	Jozef Brcka	TAZ-240	6314

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EXAMINER
DHINGRA, RAKESH KUMAR

ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
12/26/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/716,729	BRCKA, JOZEF	
	Examiner	Art Unit	
	Rakesh K. Dhingra	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 October 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-14 and 26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-14 and 26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 March 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1, 3-14 and 26 have been considered and the response is given hereunder.

Applicant has cancelled the withdrawn claims 15-18 and 20.

Accordingly claims 1, 3-14 and 26 are now pending and are active.

1) Rejections based on Tanaka in view of Usai and Khater - applicant has argued that there is no motivation to combine Tanaka with Usai since Tanaka already teaches production of highly uniform plasma and Usui teaches an inductive plasma coil on the outside of the chamber, and further since Tanaka already describes the plasma generating apparatus like that of Usai, one skilled in the art would not combine the references to add the series connection from the older art of Usui with Tanaka which already produces a highly uniform plasma as stated above.

Examiner responds that Usai reference is used for its teaching pertaining to a series RF circuit comprising of the peripheral ionization source and the substrate support. Usai teaches production of uniform and high density plasma coupled with the plasma apparatus having a simpler configuration, reduced cost and power consumption, which provides the motivation to combine Usai with Tanaka (Usai – col. 2, line 25 to col. 3, line 10). Though Usai teaches the peripheral ionization source located outside the chamber, placing the same inside the chamber would have advantages like improved uniformity of plasma density across the wafer surface, as taught by Tanaka et al (col. 2, lines 5-15).

2) Applicant's further arguments regarding use of wafer size of 200mm and not of 300 mm wafer at the time of the priority date of Usai (Dec 1993) and related likely problems of increased coil size, and further Usai having difficulties producing plasma at higher frequencies (over 1-2 MHz), besides issues of control of directionality of the process, do not correspond to the scope of the claim limitation.

3) In response to applicant's arguments against the references individually like Applicant contention that combining Usai with Tanaka would introduce other technical problems, like disruption of plasma

arrangement without other adjustments for precise location of coil (per Fig. 5 – Tanaka), examiner responds that, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In this case, Usai provides motivation for combining with Tanaka that is, production of uniform and high density plasma coupled with the plasma apparatus having a simpler configuration, reduced cost and power consumption (Usai – col. 2, line 25 to col. 3, line 10).

4) Applicant has also argued that by adding the Faraday shield of Khater to Tanaka would eliminate electric field coupling between Tanaka's coil 60 (see FIG. 5) and the plasma, and that Khater does not disclose using the Faraday shield in conjunction with an RF series circuit that connects the coil, the substrate support, and an RF source, whereas in Applicant's series circuit, the substrate support capacitively couples to the plasma at the center, while the coil which is shielded from capacitive coupling inductively couples to the plasma at the periphery.

Examiner responds that Khater teaches a Faraday shield with radial slots that enables control of capacitive coupling for plasma ignition and also prevents any significant capacitive coupling during the inductive coupling phase. Further, it is known in the art to control the capacitive and inductive coupling to the plasma by controlling the size and shape of slots in the shield. It would be obvious to dispose the Faraday shield of Khater et al between the peripheral ionization source and the plasma inside the chamber, to enable control capacitive and inductive coupling between the peripheral ionization source and the plasma, as per claims 1, 26 limitation. Thus, Tanaka in view of Usai and Khater teach all limitations of the claims 1, 26. Accordingly claims 1, 3, 8 and 26 have been rejected under 35 USC 103 (a) as explained below.

5) Further, in view of applicant's argument about Moslehi being directed to solving problems pertaining to better coverage of high aspect ratio holes by a sputtering deposition process, which are different from the efforts of Usai is found persuasive. According the rejection is withdrawn.

6) With regard to applicant's argument regarding claims 5, 9 about Moslehi not teaching a series circuit that includes the peripheral ionization source and the substrate support, the rejection is clarified as

explained below. In view of response given above, rejection of balance claims 4-7 and 9-14 under 35 USC 103 (a) is maintained as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 8 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066).

Regarding Claims 1, 3, 8: Tanaka et al teach an inductive plasma apparatus (Figures 1, 3) that includes an RF source 22 and a plasma chamber 1 with substrate support 7 (movable in up/down direction) on which a substrate 8 is supported. Tanaka et al further teach that the apparatus also includes a peripheral ionization source 20 for generating plasma in the chamber that surrounds the substrate support on the periphery of the substrate support 7. Tanaka et al also teach that the peripheral ionization source 20 is movable in up/down direction with the help of piston cylinder assembly 30 (to obtain a desired plasma field pattern) over a range from below the plane of substrate support to a plane above that of the substrate support 6 (that is, the peripheral ionization source surrounds the substrate support on the periphery of the substrate support, and the substrate support and the peripheral ionization source can form a common planar surface having a substrate support surface at its center. Tanaka et al teach that substrate 8 can be given RF bias through a clamp ring 18.

Tanaka et al additionally teach that peripheral ionization source 20 is connected to RF source 22 (for example, Figs. 1, 3 and col. 3, line 15 to col. 4, line 50).

Tanaka et al do not teach that the substrate support and the peripheral ionization source are connected in a series circuit, and also do not teach a slotted faraday shield between the inductive element and the plasma.

Usai teaches a plasma apparatus (Figures 1-4) that comprises an RF generator 6,

a series RF circuit that includes a substrate support electrode 3 and an inductive plasma coil (peripheral ionization source) 2, an RF source and a matching circuit 5 coupled to the series circuit, such that both capacitive and inductive plasma are generated within the vacuum chamber. Usai also teaches that the apparatus generates a stable high density plasma (Column 3, line 30 to Column 4, line 15). It would be obvious to connect the substrate support and the peripheral ionization source of Tanaka et al in a series circuit, as per teaching of Usai to obtain a uniform and stable high density plasma coupled with a simpler configuration of the apparatus with reduced cost and power consumption (Usai – col. 2, line 25 to col. 3, line 10).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a RF series circuit that includes the substrate support and the peripheral ionization source as taught by Usai in the apparatus of Tanaka et al to generate both inductive and capacitive plasma and thus obtain uniform and high density plasma across the wafer surface, coupled with a simpler configuration of the apparatus with reduced cost and power consumption.

Tanaka et al in view of Usai do not teach a slotted shield between peripheral ionization source and the plasma. However, use of faraday shield is known in the art to facilitate coupling of inductive energy and to limit the coupling of capacitive coupling of energy, as per reference cited below.

Khater et al teach a plasma apparatus (Figure 1) comprising a plasma chamber with an inductive source coil 130 and a Faraday shield 150 with slots 152 that controls coupling of capacitive energy during ignition and maintenance of plasma (column 5, line 54 to column 6, line 45). Further, it is known in the art to control the capacitive and inductive coupling to the plasma by controlling the size and shape of slots in the shield. Still further, it would be obvious to dispose the Faraday shield of Khater et al between the peripheral

ionization source and the plasma, to enable control capacitive and inductive coupling between the peripheral ionization source and the plasma.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a Faraday shield with slots as taught by Khater et al in the apparatus of Tanaka et al in view of Usai to enable control coupling of capacitive energy during ignition and maintenance of plasma.

Regarding Claim 26: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim (as already explained above under claim 1) including a peripheral ionization source 20 located inside the chamber 1 and that the substrate support 140 and peripheral ionization source 20 have a common fixed plane (due to up/down movement of coil 20, and the up/down movement of the substrate support 7, the substrate support and the peripheral ionization source can be fixed in a common plane). Further, it would be obvious to locate the Faraday shield of Khater et al inside the chamber of Tanaka et al, between the peripheral ionization source and the plasma, to enable control capacitive and inductive coupling between the peripheral ionization source and the plasma {Tanaka et al - col. 3, line 25 to col. 4, line 45}.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US Patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claims 1, 3, 8, 26 and further in view of Roderick (US Patent No. 6,353,206).

Regarding Claim 4: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim including that peripheral ionization source includes an antenna that surrounds the substrate support and is coupled in series with substrate support.

Tanaka et al in view of Usai and Khater et al do not teach that antenna is capacitively coupled in the RF series circuit.

Roderick teach an apparatus (Figures 4C, 4D) wherein an antenna 40 surrounds the substrate holder 30 and is capacitively coupled (through capacitor C1) in a series circuit to a RF source 31 and through another

capacitor C2 to the ground to control resonance frequency and also to minimize arcing between high voltage end of antenna and ground (column 4, line 10 to column 5, line 45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to capacitively couple the antenna with the substrate support in the series circuit as taught by Roderick in the apparatus of Tanaka et al in view of Usai and Khater et al to eliminate arcing between high voltage end of antenna and ground.

Claims 5, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US Patent No. 5,513,765) as applied to claims 1, 3, 8, 26 and further in view of Moslehi et al (US patent No. 6,471,830).

Regarding Claim 5: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim including that peripheral ionization source 3 is series connected to the substrate support 3 (Usai – Fig. 3) and matching network 5 is connected to an output of RF generator 6.

Tanaka et al in view of Usai and Khater et al do not teach the peripheral ionization source is capacitively connected at one end thereof to the matching network and is capacitively-coupled at an opposite end thereof to the substrate support surface.

Moslehi et al teach an inductive plasma apparatus (Figures 4, 6) for a semiconductor wafer processing comprising an RF generator 126, a matching network 128, a substrate support (chuck) 140 and a peripheral ionization source 116 that couples to the substrate support [Column 6, line 65 to column 10, line 8]. Moslehi et al further teach (Fig. 8A) that the peripheral ionization source 116 is capacitively connected at one end thereof to the matching network 128 (through capacitor 160), and is also capacitively-coupled at the opposite end thereof to grounding capacitors 162, and these capacitances are matched to balance capacitance at both ends of the peripheral ionization source, such that RF potential on the peripheral ionization source can be controlled. It would be obvious to provide such capacitance matching means (capacitance coupling) at the opposite end of the peripheral ionization source (where it connects with the substrate support), in view of teachings of Usai

and Moslehi et al, to control the voltage on the peripheral ionization source (Usai – Fig. 3 and Moslehi et al – col. 9, line 55 to col. 10, line 65).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a peripheral ionization source connected capacitively to matching network and the substrate support as taught by Moslehi et al in the apparatus of Tanaka et al in view of Usai and Khater et al to provide control of voltage on the peripheral ionization source and thus control coupling of RF power into the peripheral ionization source.

Regarding Claim 9: Tanaka et al in view of Usai, Khater and Moslehi et al teach that the peripheral ionization source (coil) 116 is capacitively-coupled to the substrate support surface 140 (as explained above under claim 5). Further, the matching network 128 has impedances (variable capacitors) 160 in series with the peripheral ionization source 116 that are appropriately tuned to the frequency of the RF generator 126 (col. 10, lines 45-65).

Regarding Claim 10: Moslehi et al teach that peripheral ionization source 116 is configured to inductively couple RF energy into plasma, and it forms a high density plasma that can be configured as per requirement by adjusting the height of the coil 116 with respect to substrate 138, and by controlling the shape of the coil (Moslehi et al - col. 7, lines 15-50 and col. 10, lines 1-7).

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claims 1, 3, 8, 26 and further in view of Moslehi et al (US Patent No. 6,471, 830) and Denda et al (US Patent No. 6,440,260).

Regarding Claim 6: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except that antenna 116 is capacitively coupled to substrate support surface and is capacitively coupled to chamber ground, and that matching network is capacitively coupled to substrate support surface.

Further, Moslehi et al teach that antenna 116 is capacitively coupled to substrate support 140 and is capacitively coupled to chamber ground through capacitor 162 (Fig. 8A – Moslehi et al).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to couple the antenna capacitively to substrate support surface as taught by Moslehi et al in the apparatus of Tanaka et al in view of Usai and Khater et al to enable proper matching of grounding and coupling capacitance and minimize RF potential on the antenna.

Tanaka et al in view of Usai, Khater et al and Moslehi et al do not teach matching network is capacitively coupled to substrate support surface.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 through blocking capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling (using a blocking capacitor) as taught by Denda et al in the apparatus of Tanaka et al in view of Usai, Khater et al and Moslehi et al to smooth the power applied to the substrate support.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claims 1, 3, 8, 26 and further in view of Dible et al (US Patent No. 6,042,686).

Regarding Claim 7: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except that the substrate support is an electrostatic chuck.

Dible et al teach an apparatus (Figure 1(a) that includes a substrate support 2 with electrostatic clamping system and connected to RF power source 16 through a capacitor Cd (Column 4, line 45 to Column 5, line 30).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use an electrostatic chuck to support the substrate support as taught by Dible et al in the apparatus of Tanaka et al in view of Usai and Khater et al to enable proper wafer clamping and uniform processing from center to edge of wafer (Column 5, lines 5-12).

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claims 1, 3, 8, 26 and further in view of Denda et al (US Patent No. 6,440,260) and Liu et al (US PG Pub. No. 2002/0027205).

Regarding Claim 11: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim as explained above except that matching network is capacitively coupled to substrate support and the matching network has an input end and an output end and that it comprises of inductor and that the matching network includes an inductor connected in series with the (coil) ionization source.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 capacitively coupled to substrate support through capacitor 32 (col. 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling as taught by Denda et al in the apparatus of Tanaka et al in view of Usai and Khater et al to smooth the power applied to the substrate support.

Tanaka et al in view of Usai, Khater et al and Denda et al do not teach that the matching network includes an inductor connected in series and further connected to the (coil) ionization source in series.

Liu et al teach an apparatus (Fig. 7) that includes a matching network 50 that has an inductor 125 connected in series between input and output ends of the matching network and the inductor 125 is connected in series with antenna (coils) 46 [Para. 0014].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use matching network with inductor connected in series and also connected to ionization source in series as taught by Liu et al in the apparatus of Tanaka et al in view of Usai, Khater et al and Denda et al to minimize reflective power and provide proper coupling current to the coil.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claims 1, 3, 8, 26 and further in view of Denda et al (US Patent No. 6,440,260 and Pu et al (US Patent No. 6,825,618).

Regarding Claim 12: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except the matching network is capacitively-coupled to the substrate support surface, the matching network has an input and an output and includes an inductor connected in series between the input and output, and the peripheral ionization source is connected in parallel with the inductor of the matching network.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 capacitively coupled to substrate support through capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling as taught by Denda et al in the apparatus of Tanaka et al in view of Usai and Khater et al to smooth the power applied to the substrate support.

Tanaka et al in view of Usai, Khater et al and Denda et al do not teach that the matching network includes an inductor connected in series and the (coil) ionization source is connected in parallel with the inductor of the matching circuit.

Pu et al teach an apparatus (Figure 8) that includes a matching network 31 that has an inductor 93 connected in series between input and output ends and also includes coils 40, 42 (peripheral ionization source) connected in parallel with the inductor 93 [Column 12, lines 25-45].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use matching network with inductor that is connected to ionization source in parallel as taught by Pu et al in the apparatus of Tanaka et al in view of Usai, Khater et al and Denda et al to minimize capacitive coupling between coil (ionization source) and plasma (column 12, lines 47-55).

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claims 1, 3, 8, 26 and further in view of Denda et al (US Patent No. 6,440,260) and Hanawa (US Patent No. 6.027,601).

Regarding Claim 13: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except that matching network is capacitively coupled to substrate support surface and that peripheral ionization source (coil) is connected in the matching circuit in lieu of a separate inductor.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 capacitively coupled to substrate support through capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling as taught by Denda et al in the apparatus of Tanaka et al in view of Usai and Khater et al to smooth the power applied to the substrate support.

Tanaka et al in view of Usai, Khater et al and Denda et al do not teach that peripheral ionization source (coil) is connected in the matching circuit in lieu of a separate inductor.

Hanawa teach an inductive plasma apparatus (Figures 1, 4) that includes a coil antenna 24 that provides matching between RF source 26 and the chamber (column 2, line 65 to column 3, line 15).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a peripheral ionization source instead of separate inductor for matching as taught by Hanawa in the

apparatus of Tanaka et al in view of Usai, Khater et al and Denda et al to exploit the antenna itself for matching and avoid the matching circuit elements.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claims 1, 3, 8, 26 and further in view of Denda et al (US Patent No. 6,440,260), Hanawa (US Patent No. 6.027, 601) and Moslehi et al (US Patent No. 6,471,830).

Regarding Claim 14: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except that matching network is capacitively coupled to substrate support surface and that peripheral ionization source (coil) is connected in series in the matching circuit in lieu of a separate inductor and peripheral ionization source includes individual inductive elements connected in series through stray mutual capacitance.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 capacitively coupled to substrate support through capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling as taught by Denda et al in the apparatus of Tanaka et al in view of Usai and Khater et al to smooth the power applied to the substrate support.

Tanaka et al in view of Usai, Khater et al and Denda et do not teach that peripheral ionization source (coil) is connected in the matching circuit in lieu of a separate inductor and that peripheral ionization source includes individual inductive elements connected in series through stray mutual capacitance.

Hanawa teach an inductive plasma apparatus (Figures 1, 4) that includes a coil antenna 24 that provides matching between RF source 26 and the chamber (column 2, line 65 to column 3, line 15).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a peripheral ionization source instead of separate inductor for matching as taught by Hanawa in the

apparatus of Tanaka et al in view of Usai, Khater et al and Denda et to exploit the antenna itself for matching and avoid the matching circuit elements.

Tanaka et al in view of Usai, Khater et al, Denda et al and Hanawa do not teach that peripheral ionization source includes individual inductive elements connected in series through stray mutual capacitance.

Moslehi et al teach an inductive plasma apparatus (Figures 4, 6) for a semiconductor wafer processing comprising an RF generator 126, a matching network 128, a substrate support (chuck) 140 and an ionization source (coil segment) 116 that couples to the substrate support. Moslehi et al also teach that peripheral ionization source (coil) 116 includes individual inductive elements (coils) that are connected in series through capacitors (to balance mutual stray capacitance) since all the inductive elements of the coil are grounded (Moslehi et al - Figures 8A, 8B and Column 11, lines 1-10 and Usui- Figure 1).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a shield with slots as taught by Moslehi et al in the apparatus of Tanaka et al in view of Usai, Khater et al, Denda et al and Hanawa to minimize proper matching of grounding capacitance and coupling capacitors and RF potential on the antenna (column 11, lines 1-10).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rakesh K. Dhingra

Karla Moore
Primary Examiner
Art Unit 1792